Application # 09/467,721
Submitted April 29, 2004
Reply to Office Action of January 29, 2004

I. REMARKS/ARGUMENTS

3. The Office Action dated January 29, 2004 has been carefully considered. Reconsideration of this application, in view of the following remarks, is respectfully requested.

A. References

4. The following U.S. patents were considered in the office action:

- US Patent 5,812,788 ("Agarwal"), filed September 29, 1995.
- US Patent 4,743,959 ("Frederiksen"), filed September 17, 1986.

B. Overview of Office Action

5. The office action:

a) Made the restriction requirement FINAL with regard to election of claims 11-15.

b) Provided new grounds of rejection using the same references.

c) Rejected claims 11-12, 14-15 as being anticipated by Agarwal under 35 U.S.C. 102(e).

d) Rejected claims 13 as being obvious in light of Agarwal in combination with Frederiksen under 35 U.S.C. 103(a).

C. Claim Rejections under 35 U.S.C. 102

6. The office action rejected claims 1-11, 14-15 as being anticipated by Agarwal under 35 U.S.C. 102(e).

Agarwal Misunderstood

7. The office action misunderstands Agarwal; it does not teach what the examiner relies upon it as supposedly teaching. The office action equates Agarwal's "capture processor" 104 with Applicant's "video memory which is able to receive a plurality of pixels

from said video digitizer". As seen in Fig 1, the capture processor 104 is not the memory device 112. Agarwal's video digitizer 102 is connected directly to the capture processor 104 not the memory device 112. Further, Agarwal's capture processor 104 does not pass the pixel data on to the video memory 112 as original pixel data. It first performs a number of complex operations on the entire video frame including transforming the data into "three two-dimensional component planes" (col 4, lines 19-22), thus splitting up the pixel data into separate data structures. In some cases it may sub-sample horizontally and vertically within each component plane, by selecting one component value from each 4x4 block (col 4, lines 22-26). Thus Agarwal does not store the unmodified pixel data in video memory. The data in the three planes are then optionally transformed into component bands prior to the encoding step (Fig 3, 304). (See also three separate plane inputs and the "forward wavelet transform" 502 in Fig 5.) Unlike Applicant's invention, much of the data from *each pixel* has been lost or modified, by a series of frame-wide or plane-wide processes, prior to the encoding step. Agarwal does not teach, but teaches away from, Applicant's "encoding circuit for *counting repeated instances* of a pixel value comprising *a number of pixel bits sub-sampled from each pixel* when scanning said plurality of pixels" (Claim 11(c)).

Agarwal's Disclosure

8. Agarwal discloses a complex, component plane based, block based, lossy compression method. Specifically, Agarwal sub-samples YUV signals, performs a wavelet transform to separate the Y component in multiple bands (Fig 4 of both). Each band is converted to motion vectors (Fig 6, 602 to 604) and the motion vectors are differenced to output interband differences (Fig 6, 604 to 606). A forward block transform (606) outputs coefficients. The quantizer (608) outputs quantized coefficients. Then, the quantized coefficients, not "a number

of *pixel bits sub-sampled from each pixel*", are run length encoded. After the quantized coefficients run length encoding step, a variable length coding step is used to generate an encode band. Agarwals's complex process to produce quantized coefficients is different than Applicant's "sub-sampling a number of pixel bits" from each single pixel. Agarwal's encoding circuit (Fig 5) for counting repeated instances of quantized coefficients (Fig 6, 610) is not the same as Applicant's "an encoding circuit for counting repeated instances of a pixel value comprising a number of pixel bits sub-sampled from each pixel when scanning said plurality of pixels". In fact the Agarwal's counting cannot occur *while scanning pixels* on the fly because the entire frame must be digitized, before the frame can be separated into component planes, before the planes can be transformed into blocks, before the blocks can be quantized into coefficients, before the run length coder can start counting runs of repeated coefficients.

9. Further, Agarwal's disclosure regarding 8 bit RGB component signals (column 4, lines 10-15) is not the same as Applicant's "*sub-sampling* a number of pixel bits" because the all 24 bits are preserved in the plurality of component bands and all eight bits are preserved in each component.

Applicant's Invention

10. Applicant's invention is a simple, fast, effective, one-the-fly, one-pass, clinically lossless way of compressing a video signal. As pixels are digitized and received into a video memory, the present invention is able to extract a pixel value by sub-sampling a predetermined number of bits from each pixel, and then count repeated instances of that bit-wise sub-sampled value. The encoding circuit is able to do this in one pass, on-the-fly, "when scanning" and outputs an data code for each run of extracted pixel values. While not a limitation of claim 11 as currently amended, an embodiment of this invention could hypothetically output

encoded data as soon as two or more pixels were digitized. This is much different than the methods and apparatus taught by the cited references, which must first digitize an entire frame, split the frame into multiple planes, horizontally or vertically (but not bit-wise) sub-sample the planes, and transform certain planes before the start of encoding. The present invention eliminates many steps found in the cited art and is able to provide clinically lossless results that cannot be achieved by the prior art.

D. Claims 11, 14, and 15 Not Anticipated or Made Obvious by Agarwal

11. As discussed above, Agarwal does not teach the elements of the present invention. Agarwal does not teach a machine where a plurality of pixels is received directly from a video digitizer. Agarwal does not teach counting repeated instances of a value resulting from bit-wise sub-sampling of *each* pixel. Unlike Applicant's one-pass, on-the-fly teaching, Agarwal teaches away from run length encoding when scanning and sub-sampling pixels.

12. Neither Agarwal's encoding circuit (Fig 5 "encoder" with three plane inputs), band coder (504 with a band as an input), nor run-length encoder (Fig 6, 610 for run-length encoding quantized coefficients) are the same or equivalent to the encoding circuit for run-length coding bit-wise sub-sampled values from each pixel "when scanning said plurality of pixels," as required by independent claim 11 and it's dependant claims, including claim 14 and 15. This fundamental element of the claimed invention is entirely lacking in Agarwal. For this reason alone, claim 11 and its dependent claims should now be allowed.

13. Thus, Agarwal does not teach all of the required elements of the claimed invention. Thus Agarwal does not anticipate the claimed invention.

14. Further, Agarwal teaches away from counting repeated instances of a bit-wise sub-sampled value when scanning. The present invention omits many elements of the cited

prior art, makes compression faster and simpler and results in superior image quality. The present invention goes against the grain of prevailing discrete cosign transform (DCT) and wavelet transform based compression techniques taught by the prior art. Products incorporating the present invention have been licensed and used by hospitals in the University of California system. The present invention provides many unexpected results or unappreciated advantages over the prior art as outlined in the "Objects and Advantages" section of the specification. Thus, Agarwal does not render the claims obvious.

E. Claims 12 Not Anticipated or Made Obvious by Agarwal

15. Claim 12 is a dependent claim, and, for all the reasons stated above with respect to independent claim 11, should be patentable over Agarwal.

16. As discussed above, Agarwal's disclosure regarding 8 bit RGB component signals (column 4, lines 10-15) is not the same as Applicant's "*sub-sampling* a number of pixel bits" because the all 24 bits are preserved in the plurality of component bands and all 8 bits are preserved in each component. In Applicant's invention, if the pixel had 24 bits, a *bit-wise sub-sampled* pixel value would be *less than* 24 bits, and if the pixel had 8 bits, a bit-wise sub-sampled pixel would have *less than* 8 bits. For example, Applicant's Fig 3A shows a 5-bit pixel value being sub-sampled from an 8-bit pixel and Fig 1380a shows a "24 to 5 bit sub-sampler". Agarwal does not disclose 8 as "the number of pixel bits [sub-sampled from each pixel]" but rather 8 as the number of bits split into each of three component planes. All 24 bits are still preserved, because there is no bit-wise *sub-sampling*. The cited reference does not teach bit-wise *sub-sampling to reduce the number of bits* in a pixel value as required by claim 11 and its dependent claim 12.

17. Agarwal does not teach all of the required elements of claim 12. Thus, Agarwal does not anticipate claim 12.

18. Further, Agarwal teaches away from bit-wise sub-sampling to obtain a smaller number of bits. Thus, Agarwal does not render claim 12 obvious.

F. Claim Rejections under 35 U.S.C. 103

19. The office action rejected claim 13 as being obvious in light of Agarwal in combination with Frederiksen under 35 U.S.C. 103(a).

G. Claims 13 Not Made Obvious by Agarwal and Frederiksen

20. Claim 13 is a dependent claim, and, for all the reasons stated above with respect to independent claim 11, should be patentable over Agarwal.

21. As stated above, Agarwal does not teach bit-wise sub-sampling to extract a subset of bits as the pixel value. Because Agarwal does not teach extraction of a smaller number of bits, it would not be obvious to combine Frederiksen's extraction of the most significant bits of each color component with Agarwal. There is no teaching or motivation to combine. Both references are complete in themselves and take mutually exclusive paths. Even if the references were combined, the combination would not result in Applicant's invention. The resulting combination would still take a much different, conventional approach to video compression, would include many elements omitted by the present invention, and would not have the resulting clinically lossless quality of the present invention. Thus, Agarwal in view of Frederiksen does not render claim 13 obvious.

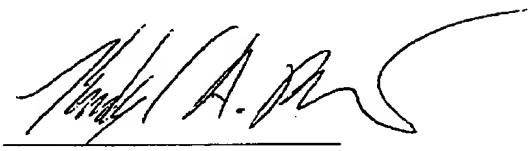
II. Reconsideration Requested

22. The undersigned respectfully submits that, in view of the foregoing amendments and remarks, the rejections of the claims raised in the Office Action have been fully

Application # 09/467,721
Submitted April 29, 2004
Reply to Office Action of January 29, 2004

addressed and overcome, and the present application is believed to be in condition for allowance. It is respectfully requested that this application be reconsidered, that these claims be allowed, and that this case be passed to issue. If it is believed that a telephone conversation would expedite the prosecution of the present application, or clarify matters with regard to its allowance, the Examiner is invited to call the undersigned inventor at 408-739-9517.

Respectfully submitted,



Kendyl A. Roman

Phone: 408-739-9517

Sunnyvale, CA
Date: April 29, 2004